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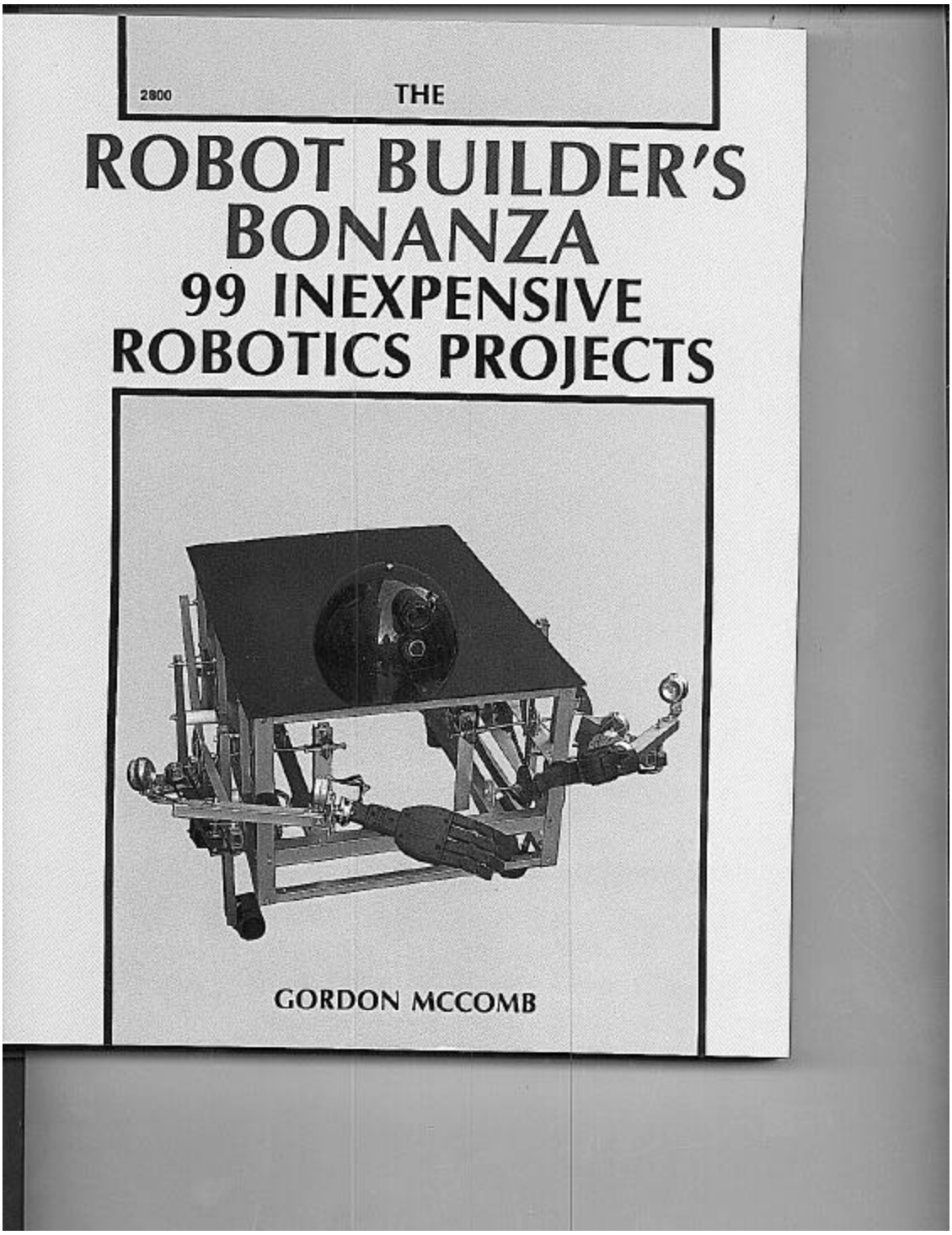

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How you can build and combine all the various parts that make up a robot. . .to create your own original, custom-designed, personal robot.

"This `cookbook' approach proposes educational but fun designs for constructing robots of all shapes, sizes and abilities."

--ALA's Booklist

"Offers a unique collection of fully tested project modules that can be mixed and match in countless combinations. The reader's imagination is the other ingredient required for the creation of highly intelligent, one-of-a-kind, working robots."

--Popular Electronics

". . . If you love using your hands and your brain, you will find much pleasure from this book of mechanics and electronic circuits."

--Practical Electronics

Now, with the help of the ***Robot Builder's Bonanza***, you can truly express your creativity. This fascinating guide offers you a complete, unique collection of tested and proven project modules that you can mix and match to create an almost endless variety of highly intelligent and workable robot creatures.

By using a modular "cookbook" approach, there's plenty of leeway left for your imagination. Here are over 99 different experiments that you can use in different combinations to create robots of all shapes, sizes, and abilities. Rolling robots, walking robots, talking robots . . . robots that can vacuum the floor, serve drinks, teach the kids, protect the family against fire or intruders . . . anything is possible using these modules and a little ingenuity. Best of all, none of these projects will put a strain on your budget. The majority of the IC's you'll use in the circuits are budget-priced surplus parts.

Geared to both novice and intermediate robotics enthusiasts, the projects include all the necessary information you need to construct the essential building blocks that go into the typical personal robot: the body and frame; power and locomotion; appendages; eyes, ears, and mouth; navigation; and electronic control. How you put them all together is up to you! Suggested alternative approaches and sources of electronic and mechanical components are provided. In addition to the abundance of illustrations, schematics, diagrams, and parts lists, you'll also find a listing of all the tools and equipment you'll need, a handy guide for matching up TTL's and IC's, a drill bit and bolt chart, and computer programs for supplying your droid with more than switches for control.

A certified electronic technician, Gordon McComb owns and operates a successful VCR and electronics repair business. He is the West Coast editor to *Computer Buyer's Guide and Handbook* and is also a contributing editor to *MacWorld*. He has written ten books and over 1000 magazine articles for such publications as *Popular Science, Omni, Video, Home Mechanix, Family Handyman* and dozens of other top magazines.

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Introduction

The word *robot* is defined as a mechanical device that is capable of performing human tasks or behaving in a human-like manner. No argument here. The description certainly fits.

To the robotics experimenter, however, the word robot has a completely different meaning. A robot is a special brew of motors, solenoids, wires, and assorted electronic odds-and-ends, a marriage of mechanical and electronic gizmos.

Taken together, the parts make a personable creature that can vacuum the floor, serve drinks, protect the family against intruders and fire, entertain, educate, and lots more. In fact, there's almost no limit to what a well-designed robot can do.

Robotics, like rocketry, television, and countless other technology-based industries, started small. But growth and progress have been slow. Robotics is still a cottage industry, even considering the special-purpose automatons now in wide use in the car industry. The science of personal robotics--the R2-D2 and C-3PO kind of "Star Wars" fame--is even smaller--an infant in a brand new family on the block. All that this means is, for the robotics experimenter, there is plenty of room for growth. There are a lot of discoveries yet to be made.

INSIDE *THE ROBOT BUILDER'S BONANZA*

The Robot Builder's Bonanza takes an educational but fun approach to designing working robots. Its modular projects take you from building basic motorized platforms to giving the machine a brain--and teaching it to walk and talk and obey commands.

If you are interested in mechanics, electronics, or robotics, you'll find this book a treasure chest of information and ideas on making thinking machines. The projects include all the necessary information on how to construct the essential building blocks of a personal robot. Suggested alternative approaches, parts lists, and possible sources of electronic and mechanical components are also provided where appropriate.

Several good books have been written on how to design and build your own robot. These have been aimed at making just one or two fairly sophisticated automatons, and at a great price. Because of the complexity of the robots detailed in these books, they require a fairly high level of expertise and pocket money on your part.

This book is different. Its modular *cookbook* approach offers a mountain of practical, easy to follow, and inexpensive robot experiments. Taken together, the modular projects in *The Robot Builder's Bonanza* can be

combined to create several different types of highly intelligent and workable robots, of all shapes and sizes--rolling robots, walking robots, talking robots, you name it. You can mix and match projects as desired.

How to Use This Book

This text could be divided into seven sections. Each section would cover a major component of the common personal or hobby (as opposed to commercial or industrial) robot. The sections would be:

- Robot Basics--What you need to get started; setting up shop; how and where to buy robot parts.
- Body and Frame--Robots made of plastic, wood, and metal; working with common metal stock; converting toys into robots.
- Power and Locomotion--Using batteries; powering the robot; working with dc and stepper motors; gear trains; walking robot systems; special robot locomotion systems.
- Appendages--Building robot arms and hands; adding the sense of touch.
- Eyes, Ears, and Mouth--Speech synthesis; music and sound effect generation; sound detection; robot eyes; smoke, flame, and heat detection.
- Navigation--Collision detection; collision avoidance; ultrasonic ranging; infrared beacon systems; track guidance, navigation.
- Electronic Control--Infrared remote control; ultrasonic remote control; radio links; robot control with computer parallel port; computer system bus interface; on-board computer systems.

The chapters tell you how to build the many parts that go into the typical hobby robot. Most chapters present one or more projects that you can duplicate for your own robot creations. Whenever practical, I designed the components as discrete building blocks, so that you can combine the blocks in just about any configuration you desire. The robot you create will be uniquely yours, and yours alone.

If you have some experience in electronics, mechanics, or robot building in general, you can skip around and read only those chapters that provide the information you're looking for. The chapters are very much stand-alone modules, like the robot designs presented. This allows you to pick and choose, using your time to its best advantage.

If you're new to robot building, and the varied disciplines that go into it, you should take a more pedestrain approach and read as much of the book as possible. In this way, you'll get a thorough understanding of how robots tick. When you finish the book, you'll know the kind of robot(s) you'll want to make, and how you'll make them.

Conventions Used in This Book

You need little advance information before you can jump head-first into this book, but you should take note of a few conventions I've used in the description of electronic parts, and the schematic diagrams for the electronic circuits.

TTL integrated circuits are referenced by their standard 74XX number. The "LS" identifier is assumed. I built most of the circuits using LS TTL chips, but the projects should work with the other TTL family chips: the standard (non-LS) chips, as well as those with the S, ALS, and C identifiers. If you use a type of TTL chip other than LS, you should consider current consumption, fanout, and other design criteria. These may affect the operation or performance of the circuit.

The chart in Fig I-1 details the conventions used in the schematic diagrams. Note that non-connected wires are shown by a direct cross or lines, or a broken line. Connected wires are only shown by the connecting dot.

Details on the specific parts used in the circuits are provided in the Parts List tables that accompany the schematic. Refer to the Parts List for information on resistor and capacitor type, tolerance, and watt or voltage rating.

In all full circuit schematics, the parts are referenced by component type and followed by a number.

- U means an integrated circuit (IC).
- R means a resistor or potentiometer (variable resistor).
- C means a capacitor.
- D means a diode, a zener diode, and sometimes a light sensitive phototransistor.
- Q means a transistor and sometimes a light sensitive photodiode.
- LED means a light emitting diode (most any visible LED will do, unless the Parts List specifically calls for an infrared LED).
- XTL or XTAL means a crystal or ceramic resonator.
- Finally, S means a switch; RL means a relay, SPKR means a speaker, TR means a transducer (usually ultrasonic), MIC means a microphone.

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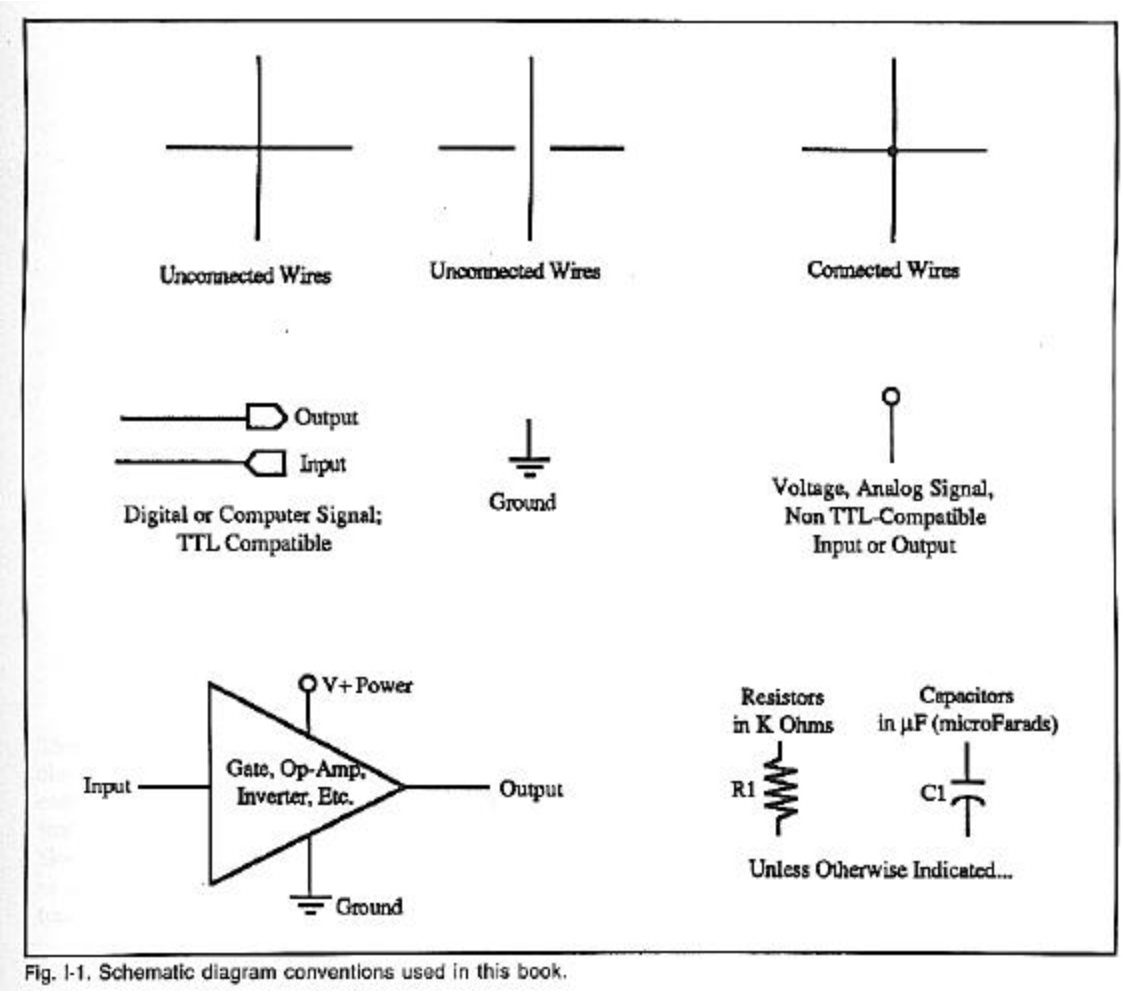

Fig. I-1. Schematic diagram conventions used in this book.